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DEPARTMENT OF THE INTERIOR

UNITED STATES BUREAU OF MINES
JOHN W. FINCH, DIRECTOR

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THE NEW BUREAU OF MINES SOUTHERN EXPERIMENT STATION AT THE UNIVERSITY OF ALABAMA, TUSCALOOSA, ALA.

BY

MILTON H. FIES

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DEPARTMENT OF THE INTERIOR-BUREAU OF MINES

THE NEW BUREAU OF MINES SOUTHERN EXPERIMENT STATION AT THE UNIVERSITY OF ALABAMA, TUSCALOOSA, ALA.[1]

By Milton H. Fies[2]

The dedication of this building, establishing a station of the U.S. Bureau of Mines at the University of Alabama, bristles with significance and challenges the wisdom and courage of the people of this State.

Here is united, in common aim, the Engineering School of our State University, recognized for its competency and usefulness, and the Federal Bureau of Mines. The Bureau is one of the most effective arms of our National Government. It outranks in accomplishment, measured by practical scientific contribution, any like governmental organization in all the other nations. It possesses none of the characteristics of many other bureaus of government which have created popular bias. Here is one Bureau devoid of political suggestion or aim with a personnel zealously devoted to labor in scientific research - an organization marked by practical accomplishment, alleviating many of life's burdens, making easier life's pathway, and unerringly pointing to life's possibilities.

In this union of the state university with the Bureau, Alabama will be blessed through the years by the labor of men who do not conjecture. The man of science, with broad conception, never forgets that 2 and 2 make 4.

The all-absorbing problem in our country and in all nations of the earth is the correct procedure in balancing agriculture and industry. A platitude is ventured when it is asserted that the issue is vital, because the possibilities of our cultural development are limited by our economic progress. The growth of industry made possible the growth in agriculture. Because the balance now lies with agriculture, shall our future actions tend to permanent curtailment of agriculture or to encouragement and development of industry?

Research, through science in industry, is the surest means to our economic salvation, and here, in Alabama, the potentialities to this end are infinite. This building marks the beginning of a new era in the State.

We shall learn much from the Bureau of Mines now that it has become so integral a part of our State. Its annual operating expense compared to the annual production value of the industries it serves is less, by far, than that of any other similar department of the Government. Its varied attainments,

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Presented at the Dedication Ceremony on May 26, 1936.

2/ Vice president, DeBardeleben Coal Corporation, Birmingham, Ala.

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marked by the absence of any flare, are inspirational. Outstanding have been its results in the field of safety and health for workers; in research covering subsidence of the earth's strata in mining, a matter of great importance in the recovery of minerals; in technologic investigations covering its practical use of the Nation's vast mineral deposits as they relate to their mining, concentration, and chemistry; in a noteworthy study of the chemistry and use of explosives; and in the compilation of accurate, dependable statistics, always unbiased and uncolored. The importance of an alliance with an organization of this type cannot be overstressed.

No greater assurance can be voiced for our future than in the statement that when men like Davis[3/], Lloyd[4/], Gallalee[5/], Andrews[6/], and Cudworth[7/] join hands with men like Finch[8/], Rice[9/], Paul[10/], Harrington[11/], Fieldner[12/] and Gandrud[13/] we have the ultimate in courage and ability to hew out the path to scientific progress. In no university in the country is there a group of men whose feet are more solidly on the ground than the members of the engineering faculty of this university whose names I have just mentioned. And need I add that our presence here on this occasion is due entirely to the keenness of perception, the determination, and the vision of that unconquerable spirit, the President and maker of this university[14/].

To the Bureau, Alabama, in a material way, offers a field unlimited in its fertility. The nature of our coal seams is such as will prove responsive to research in the three fields in which such research is applicable to all coals; our ferrous ores, particularly those of relatively low iron content, require the most profound scientific consideration, the nonferrous ores of this State present a virgin field for investigation. Study of the metallurgy of iron and steel and their alloys will further demonstrate that such metals made from southern ores can be adapted to man's every need.

3/ Davis, George Jacob, Jr., Dean, College of Engineering, University of Alabama, University, Ala.
4/ Lloyd, Stewart, J., Dean, School of Chemistry, Metallurgy, and Ceramics, University of Alabama, University, Ala.
5/ Gallalee, John M., Professor of Mechanical Engineering, University of Alabama, University, Ala.
6/ Andrews, Thomas Gayleon, Assistant Professor of Geology, University of Alabama, University, Ala.
7/ Cudworth, James R., Director of School of Mines, University of Alabama, University, Ala.
8/ Finch, John W., Director, U.S. Bureau of Mines, Washington, D.C.
9/ Rice, George S., Chief Mining Engineer, U.S. Bureau of Mines, Washington, D.C.
10/ Paul, James W., former Senior Mining Engineer, U.S. Bureau of Mines, Pittsburgh, Pa.
11/ Harrington, D., Chief, Health and Safety Branch, U.S. Bureau of Mines Washington, D.C.
12/ Fieldner, A.C., Chief Engineer, Experiment Stations Division, U.S. Bureau of Mines, Washington, D.C.
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I shall refer briefly to several subjects which may well engross the scientists who will work here. The staffs of the University and of the Bureau are conversant with each of them and many more. I dwell upon them solely in an effort to impress upon the layman what this day will mean in the industrial life of our State.

Before discussing the necessity for research work on Alabama coal in its three important phases, it should be stated that a study should be made of present mining methods in order to determine some system whereby a greater percentage of our valuable coals can be recovered. Here is a program of conservation sorely needed in this State.

There are but three approaches to research in coal, and, while the number is limited, each of the three is limitless within itself.

The uses of coal involve combustion, carbonization, and hydrogenation. The first concerns our immediate present; the others afford a hopeful future.

Research in combustion will serve two important purposes. First, it will improve utilization, thus enabling the coal industry to survive until a satisfactory solution of the other two problems is found. Second, since all three involve heat, results obtained from study of combustion will be of the greatest possible value in research covering carbonization and hydrogenation.

Consideration of each related subject will be a function of the Bureau and the University. Brief reference is made to each:

Roughly, 85 percent of the coal mined in our country is burned in its "raw" state. Obviously, cleaning or preparation, which insures quality, is an essential prerequisite; studies covering proper specification of coal are valuable; and design and selection of equipment for various coals are likewise salient. The study of combustion will include temperature, particularly its uniformity and conductivity, and cleanliness of fuel for use of coal for heating. This study will lead to consideration of the mechanism of thermal decomposition of coal, particularly as it relates to liberation of volatile matter, and the characteristics of the combustion of coal on grates. The results obtained from a study of thermal decomposition will contribute much to research in the other two fields.

The investigation of appliances involves research in ash fusion, clinkering, caking, air control, furnace linings, and the regulation and handling of fuels and ashes.

Storage of Alabama coals will prove an interesting study. The grindability of the various seams is important. Research on the chemistry of combustion will broaden the markets for Alabama's coal. As practically all of Alabama's steam coal is washed, a proper, inexpensive method of drying the coal opens up a new realm of investigation for the Bureau. A determination of costs in unwatering Alabama washed coals, which are relatively high in moisture content, will be useful. Direct heating derived from washer middlings, the possi-

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ble use of hot gases from culm piles, and new methods of centrifugal drying will entice the student in this sphere. Alabama coal has suffered from this moisture encumbrance, not only in competition from oil and gas but also in competition with coals from adjoining fields.

It has been pointed out that the engineer, with only meager scientific cooperation, has increased the number of kilowatt-hours per pound of coal from 0.31 in 1919 to 0.69 in 1934 and has increased the 1,000 gross ton-miles of freight hauled from 6.1 to 8.3 in the same period, and proportionate increased efficiencies in other uses have been obtained. The imagination need not run riot to foresee further and more pronounced results from work to be done here by the engineer and the scientist.

The future of the commercial coal industry of the State lies in the carbonization of coal, particularly at low temperatures. Because of continued discussion of this question, I have attained the status of the proverbial local prophet. My enthusiasm on this subject can never wane. The most conservative realist should enthuse over the anticipation.

Alabama's high-volatile coals possess many advantages, and its relatively noncoking coals may come into their own.

From carbonization we shall undoubtedly derive commercially a gas of high calorific value, possibly exceeding that of natural gas; valuable byproducts, particularly from the chemistry of the resultant tar; a clean fuel of high efficiency with improved kindling and burning properties; and a crude oil suitable for refining into nearly all petroleum products.

Dr. Lloyd, of this university, within the last year correctly prophesied that the great network of natural-gas pipe lines throughout the Southeast will some day carry coal gas to the areas which they serve. Moreover, if we have any recurrence of sudden diminishing pressure in the great producing field similar to that which took place within the last 18 months in another field, his prediction will be realized earlier than he or anyone else may have anticipated. We must be ready when the time comes, and this institution will aid in preparing us for the day.

Alabama has achieved much in high-temperature carbonization, but we still have many problems. We have yet to make, according to many authorities, a good foundry coke without importing and using a mixture with coals from other fields.

We need to broaden our knowledge of the effect of coking time on the quality of blast-furnace coke.

The subject of pretreatment of coal for carbonization is a new and important matter for research. If we could solve this question, we would probably avoid the expense of new ovens in this district for some time to come, because of possible increased yields per oven.

We must determine some chemical process, through a better understand-

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ing of tar byproducts, so as to avoid burning such a large percentage of tar as a fuel. The chemistry of coal's byproducts is as broad as organic chemistry itself.

The hydrogenation of coal is a fascinating topic with definite promise. This method of making a liquid motor fuel is being successfully worked out commercially in Germany and, with government subsidy, in England. Groping in the dark, with all essentials unknown, the process offers opportunity for simplification and reduced cost. This is evident when I quote a recent description of the process: "Coal of unknown chemical constitution is suspended in a liquid medium, which exerts an unknown solvent, or dispersing action, on it; the mixture is then treated with hydrogen which acts in an unknown way, at an elevated temperature, which itself has an unknown effect on the coal used. The chemical constituency of the products obtained is unknown; the reaction is carried out in the presence of catalysts whose specific effects are still unknown.

When one considers that many geologists have determined to their own definite satisfaction that in this country we will experience a shortage of petroleum in from 5 to 8 years and exhaustion in 50 years, the importance of hydrogenation of coal can readily be appreciated. An executive of the Standard Oil Co. in 1934, before a House Committee on Petroleum Investigation, stated that gasoline could be made from coal with existing processes at 12 cents per gallon as compared to 5 cents per gallon from petroleum. This difference is less than the total tax on gasoline in the City of Birmingham. Intensive research will reduce this difference in cost. A program of research in this process warrants not only the support of the coal, oil, and chemical industries but, in the interest of national economy, deserves encouragement from all people.

I have stressed the necessity of research in coal to an undue extent because in the commercial coal industry in Alabama we have the last vestige of the only great mineral industry owned largely by Alabamians. We must hold on at any cost. And it may not be amiss to remind this great University - a large owner of fine coal properties - that it is unwise to lease coal properties unless financial pressure requires and then only when there is no other means available.

These following problems relating to iron and iron ore should prove absorbing:

A method of sintering or nudulizing the fines so as to avoid the loss in flue gas.

Some practical and economical method of concentrating the lowgrade red ores of the Birmingham District.

More detailed surveys of strata overlying the ore measure to definitely determine the course and area of the water-bearing strata in order to recover, by underground mining, a larger percentage of the high-grade ores, thereby conserving one of the most important minerals of the district.

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Research work on blast-furnace slag to determine what quality of slag wool can be made in the South. A product of this type is coming into general use in the North for insulating material in buildings of all types and for other uses. Undoubtedly, a large market could be had for this product provided it is made equal in quality to the insulating material made from Indiana limestones.

Some practical and economical method of reducing phosphorus in pig iron, either while ores are being reduced in the furnace or in a secondary operation. If this could be accomplished, it would materially enlarge the area in which southern pig iron could be sold.

The effect of properly sizing the red hematite ores of the Birmingham district upon their rate of reducibility in blast furnaces.

The percentage of phosphorus in the product at which blast-furnace gases prove hazardous to furnace operation.

A study of the effect of zinc oxide on blast-furnace lining.

A study of the effect of grain size of pig iron upon the resultant castings.

The effects of more intimate mixing of blast-furnace raw materials.

A study of the possibility of the economic recovery of potash from blast-furnace gases and flue dust.

In the manufacture of steel the following problems offer a field for research:

A study of the improvement and quality of open-hearth refractories.

The effect of the rate of carbon drop upon the quality of the resultant steel.

Slag control.

Commercial uses of open-hearth slags.

Study of the recovery of phosphorus in the form of ferrophosphorus from open-hearth slags.

Among our nonferrous ores, there is great possibility in the Southeast in the study of graphite, gold, shales, silica; asphaltic rock from northwest Alabama; and dolomite for production of magnesium and magnesium compounds. Consideration of certain of these minerals would greatly benefit the cement industry of this State.

The foregoing meager outline, indicates some of the work to be accomplished here.

Now, what part should the mineral and metallurgical industries play? Sympathetic interest will not suffice. Interested action is required.

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The Bureau of Mines desires your technical problems. Twenty-five years association with the work of the Bureau convinces me that these men have the greatest pride in practical solution to problems. You may count upon them.

Industry should shoulder the duty of furthering the Bureau's interest by adequate appropriation. There will be no waste of the taxpayer's money here.

In addition, the coal, iron, and steel business of Alabama should immediately establish at least three research fellowships, one for each industry, open to graduate engineers and metallurgists throughout the Nation, for work in this station on Alabama coal, ore, iron, and steel; and, as the work progresses, these fellowships should be augmented. There should be no hesitation or delay. Spontaneity should characterize this movement.

The complete absence of correlated and integrated research has retarded the progress of our State and other States in this area. The opening of this new station is the beginning of an approach to our economic problems which will not only change our economic status but elevate our standards and inspire our lives. For nearly three-quarters of a century, we have struggled against almost insurmountable handicaps. Loyal to the traditions and dreams of the South, we have reached this day. Still faithful to them, we shall build more strongly for the future because of work which will be done here. In this type of governmental aid we have what many believe to be a correct function of government - that is, to aid in providing opportunity in order that men may lift themselves. No fair-minded citizen expects more.

It may be that if in Alabama we have a second visitation of a meteoric shower we shall be better prepared to absorb additional iron into our system because of what we shall do and learn here. Just an indication of a trace of iron in certain quarters in Alabama would prove a very desirable acquisition.

Material progress will obliterate illiteracy; the byproducts of coal and the concentration of our iron ores will solve the problem of the tenant farmer; and development of our nonferrous ores may revivify that which was best in the culture of the Old South.

With the fulfillment of these dreams, the Nation shall become enriched - repaid, if you will, because of its generosity here.

We Alabamians must shake off the apathy which has so long possessed us. Too long already have our failures colored our history. The time is ripe to change our tempo. This building, these men, will prove the divining rod showing the hidden springs of measureless opportunity, and, generations hence, men of this State will be "marching to a measure" dreamed here and now.

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